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Lameness in crossbred cows: Prevalence, host level risk factors and reproductive performance*

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Lameness, a chronic form of disease/stress, has been recognized as a serious deterrent to dairy economics through reduced reproductive and production potential and increased culling rate of the affected cows (Hernandez *et al.* 2005), which makes lameness as the third most expensive disease after mastitis and reproductive losses in the European and American cattle. There are some reports on incidence of lameness and hoof disorders in Indian cows (Chawla *et al.* 1991, Singh *et al.* 1999). Information pertaining to severity of lameness vis-à-vis host level risk factors (Peterse 1980) and reproductive performance (Hernandez *et al.* 2001) is available in the cows raised abroad which, however, cannot be extrapolated in the Indian cows due to breed variation and emphatic differences in management and climate, therefore present study was done.

Animals and management: Adult crossbred cows (1053) belonging to 17 different organized farms or farmer having a cattle strength ranging from 5 to 506, were used. The cows were crosses primarily between Holstein Friesian and local cattle, viz. Sahiwal, Hariana and Red Sindhi mixed-blood. The cows were housed loose, semi-loose or a tie barn system. The footing surface was brick/cement–concrete. The animals at different dairy farms were kept on standard feeding schedule including seasonal green fodder, wheat straw, silage and adequate quantity of concentrate ration. However, there was a variation in the feeding of roughages and concentrates to the cows belonging to rural farmers. Nevertheless, the basic diet included similar seasonal green fodder and wheat straw.

Identification and scoring of lameness The locomotory status of all the cows was assessed, preferably after evening milking, by visual observations while the animals walked on a firm footing surface for a minimum of 15 m. Presence and degree of lameness was quantified as per Wells *et al.* (1993). The cows included as lame in the study had normal musculo-skeletal system of the limbs thereby indicating hoof disorders as the underlying cause of lameness (Murray *et al.* 1996).

Host level risk factors and fertility: Certain host level risk factors such as age, parity, body weight, current milk yield, amount of concentrate fed, stage of lactation and reproductive diseases (endometritis / retained placenta in the immediately preceding calving) were assessed separately in relation to prevalence and degree of lameness, respectively. However, due to lack of any significant relationship between the current milk yield, amount of concentrate fed, stage of lactation and reproductive diseases with lameness, the said variables were excluded from further analysis. The age of the cows (years) was categorized as < 3, 3–5 and > 5 and was assigned a code of A-1, A-2 and A-3, respectively. The lactation number from 1 to 10 was correspondingly categorized as L-1 to L-10. The body weight (kg) of the cows was categorized as 300 – 350, 351 – 450 and > 450, with corresponding assigned code of BW-1, BW-2 and BW-3, respectively.

The breeding record following last calving was collected for individual animal. In addition, clinico-gynaecological examination of each selected cow was also performed. The cows that were regularly cyclic and non-pregnant or otherwise pregnant from three or less inseminations were considered as fertile, whereas the other regularly cyclic non-pregnant and pregnant cows that had been inseminated on more than three occasions were considered as repeat breeders. The pregnant cows included in the study were the ones with a gestation of 60 days or less. In the latter situation, pregnancy was confirmed after 2–3 months. The cows diagnosed as true anestrus were confirmed by a second examination 10–12 d later. From the data and examination record, the interval from calving to first service, interval from calving to conception, pregnancy rate to first service and number of services per conception were calculated and the observations between

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the lame and normal cows was compared.

Statistical analysis: The association of host level risk factors with lameness was analysed using multiple analysis of variance. The reproductive indices between non-lame and lame cows were compared using Student's *t* – test and Chi-square analysis. A statistical difference of P<0.05 (at least) was considered as significant, whereas P<0.10 was considered as a tendency for difference. The entire statistical analysis was done using SPSS (12.0) for windows.

Lameness, a pain associated malady, changes the behavior and lowers the reproductive potential of the affected animals possibly through alterations in delicately poised endocrine events regulating reproduction (Barkema *et al*. 1994). In spite of worldwide importance of cattle lameness only a limited work on lameness in the Indian crossbred cows is on record. Further, the cow related factors leading to lameness and fertility indices *per se* are obscure.

Prevalence and severity of lameness: Overall prevalence of lameness, 30.5%, was higher than previous Indian reports of 8.1–9.2% (Chawla *et al.* 1991, Singh *et al.* 1999). This upward trend in prevalence of lameness in Indian cows simulates to the reports in the exotic cows indicating increase in lameness from 17.3 to 69.0% (Tadich *et al.* 2010). The proportion of mild, moderate and severe form of lameness in the present study was 54.9, 38.2 and 6.9%, respectively, which differed from a previous study revealing the 3 different severities of lameness in 22.6, 52.8 and 20.6% cows, respectively (Singh *et al*. 1999). The discrepancy in prevalence and proportion of severity of lameness between the previous and current study in Indian cattle could be attributed to variation in cattle breeds. Jersey crossbreds predominated in the study of Singh *et al.* (1999), whereas in the current study it was Holstein Friesian crossbreds. The latter are more vulnerable to lameness due to a relatively softer hoof structure than Jersey (Webster 1987).

Association of host level risk factors with lameness and its severity: There was a strong negative correlation between parity and prevalence of lameness (r = -0.7, P<0.01). In terms of lactation number, 81.8% of the lame cows were in L-1 to L-5, with lameness varying from 11.4 to 19.8% in these lactations. The remaining 18.2% lame cows belonged to L-6 to L-10. More lameness in cows between L-1 and L-5 can be attributed to increase in lactation yield till fourth to fifth lactation (Wells *et al.* 1993), which is associated with a greater metabolic strain, higher concentrate feeding, provision of easily fermentable carbohydrates coupled with low fiber intake, all of which increase the hoof disorders culminating into lameness (Webster 2001). Age was negatively and significantly correlated (r = - 0.5, P<0.05) with degree of lameness in cows. In terms of age, lameness was most prevalent in A-3 (44.4%), followed by A-2 (35.4%) and A-1 (20.2%) groups. The percentage of mild, moderate and severe lameness was 42.1%, 42.1% and 15.8% in A-1, 50.6%, 45.5% and 3.9% in A-2 and 78.8%, 19.7% and 1.5% in A-3, respectively. Highest percentage of lameness in the cows ageing more than 5 years (A-3) could be due to ageing process as also recorded earlier (Chesterton *et al.* 2008). Moreover, repetitive insults and slower recovery rate of the hoof affections to have occurred previously could be another reason (Peterse 1980). Increase in mild form of lameness with increase in age of cows is another important finding and makes it reasonable to assume that in absence of suitable lameness prevention protocol individual cows could become progressively more lame with time. There was a tendency for a negative correlation (r = -0.3, P<0.06) between the body weight and severity of lameness. The order of prevalence of lameness of different severities in the BW-1 was highest for severe (49.3%) followed by mild (12.9%) and moderate (5.6%) lameness. In BW-2, highest percentage of cows were affected with moderate, followed by almost similar mild and severe lameness, the values being 55.3%, 37.8% and 36.3%, respectively. In the BW-3 category, mild lameness was more prevalent than moderate (63.7% vs. 36.3%) without any cow with severe lameness. The latter findings were interpreted as - more number of cows having severe lameness were <350 kg, whereas majority of the cows with mild lameness weighed >450 kg. Hence, it was inferred that severe lameness affects maintenance of body functions (Barkema *et al.* 1994) and can be a potential reason for a precipitously lower body weight in the affected cows. The finding gains support from a study in which daily live weight measurements indicated an average loss of 61 kg before lameness became apparent and could be diagnosed in cows finally exhibiting moderate /severe lameness (Alawneh *et al.* 2012).

Effect of lameness on the reproductive indices: The data pertaining to conceived to served (%), calving to conception interval, pregnancy rate to first service and services per conception was affected most in the severely lame followed by the moderately lame cows (Table 1). This is in consonance to a previous work citing deleterious effects of lameness to be amplified with an increase in severity of lameness in the cows raised abroad (Hernandez *et al.* 2001), which probably justifies lack of any appreciable effect in the investigated parameters between the mildly lame and normal cows. In earlier studies, presence of lameness reduced the conception rate to first service (45.9% vs. 66.3) (Collick *et al.* 1989), increased the number of services per conception by 1 (Mohamadnia *et al.* 2008) or 2 (Hernandez *et al.* 2001) and extended the calving to conception interval (100–170 d vs 60–100) (Hernandez *et al.* 2001). The possible underlying mechanisms affecting conception in the lame cows could be attributed to perturbed follicular dynamics. Authors also found a delayed selection and longer persistence of the dominant follicle in lame compared to normal cows (Sood *et al.* 2009), which lowers the pregnancy rates (Hernandez *et al.* 2005).

Effect of lameness on the percentage of infertile cows: Significantly lesser cows with moderate and severe lameness

Table 1. Effect of lameness on reproduction indices and fertility status in the crossbred cows

Characteristic	Non-lame	Lame (degree of lameness)		
		Mild	Moderate	Severe
Reproduction indices				
Number	731	177	123	22
Mean lactation number	3.4±0.1	3.9±0.2	3.1±0.3	4.4±0.7
Mean calving to 1st service interval (d)	81.2±2.3	82.8±4.1	90.3±5.0	85.3±3.0
No. conceived	392	96	55	3
Conceived to served %	60.0[a]	64.8[a]	59.8[a]	15.0[c]
Mean calving to conception interval (d)	134.1±14.9[a]	142.7±20.0	168.1±15.9	174.6±3.9[c]
Pregnancy rate to first service	48.1%[a]	48.9%	36.3%[b]	0%[c]
Services per conception	2.2±0.2 [a]	2.4±0.1 [a]	2.7±0.2 [a]	5.3±0.3[c]
Fertility status				
Normal cyclic	59.3[a]	54.8	36.5[b]	36.4 [b]
Repeat breeders	31.7 [a]	28.8	30.8	54.5[c]
Anoestrus	10.6 [a]	16.4 [b]	25.2 [c]	9.1

[a, b] and [a, c] within same row differ at (P<0.05) and (P<0.01), respectively.

were normal cyclic, whereas more than half of the severely lame cows were repeat breeders. Presence of anoestrus was significantly higher in cows with mild and moderate lame cows (Table 1). These findings reaffirm a direct relationship between severity of lameness and reproductive aberrations due to a hypersensitive hypothalamo-pituitary-adrenal axis, as recorded in moderately lame cows (Sood *et al.* 2012). The present information is a strong indication for considering lameness as a serious impediment in the Indian dairy industry. The subject demands a faster pace and urgent redressal in India.

SUMMARY

A visual assessment of 1 053 adult crossbred cattle for lameness revealed a prevalence of 30.5%; mild, moderate and severe lameness being detectable in 54.9, 38.2 and 6.9% cattle, respectively. Amongst different host factors, parity was significantly associated with presence of lameness, whereas age and body weight were significantly associated with degree of lameness. Cows with severe lameness compared to normal cows had significantly extended calving to conception interval, lower pregnancy rate to first service, more number of services per conception and higher evidence of repeat breeding. The moderately lame compared to normal cows exhibited significantly lower pregnancy rate to first service and higher evidence of anestrus. Overall, there was a negative association between fertility and severity of lameness. The findings are a first record in Indian cows.

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